Predicting Cranial Computed Tomography Results of Head Injury Patients Using an Artificial Neural Network

Hsu MH[1,2], Li YC[1]

[1]Graduate Institute of Medical Informatics, Taipei Medical University, Taiwan.

[2]Taipei Municipal Chung-Hsiao Hospital, Taiwan

Abstract

We conducted this study to determine if artificial neural network modeling would predict cranial computed tomography results in head injury patients using different combinations of clinical variables. 150 consecutive patients admitted to a regional trauma center with head injury were enrolled in the study. The CT was labeled with presence of surgically significant intracranial hematoma (SSIH), if midline shift, obliteration of ambient cistern or basal cistern were found. The best performance of our models to differentiate normal from abnormal cranial CT and detection of SSIH was ideal.

The first clinical CT scanner was built and installed by Godfrey Hounsfield in 1971. Since then cranial computed tomography is the most important tool for diagnosis of head trauma. However the indication to request cranial CT scans for head injury patients is controversial. More reliable prediction of the results of cranial CT in head injury patients would be helpful for clinicians to decide whether to request emergency cranial CT scans or not.

We developed neural network models to predict cranial computed tomography results in head injury patients using different combinations of clinical variables.

150 consecutive patients admitted to a regional trauma center with head injury were enrolled in the study. Clinical variables (Age, Sex, Glasgow coma scale, Systolic blood pressure, Diastolic blood pressure, Heart rate, Respiration rate, pupil response, cause of injury) and CT characteristics (Brain swelling, Skull fracture, Type of hematoma, midline shift, obliteration of ambient cistern or basal cistern) were recorded. If midline shift, obliteration of ambient cistern or basal cistern was found ,the CT was labeled with presence of surgically significant intracranial hematoma(SSIH). 100 cases were used to develop the models; and 50 cases were used to test the accuracy, sensitivity, and specificity of the models. Totally, nine sets of neural network models were developed.

The beat performance of our models to differentiate normal from abnormal cranial CT (Sensitivity 81.48%, Specificity 100%) and detection of SSIH (Sensitivity 92.11%, Specificity 83.33%) was ideal.